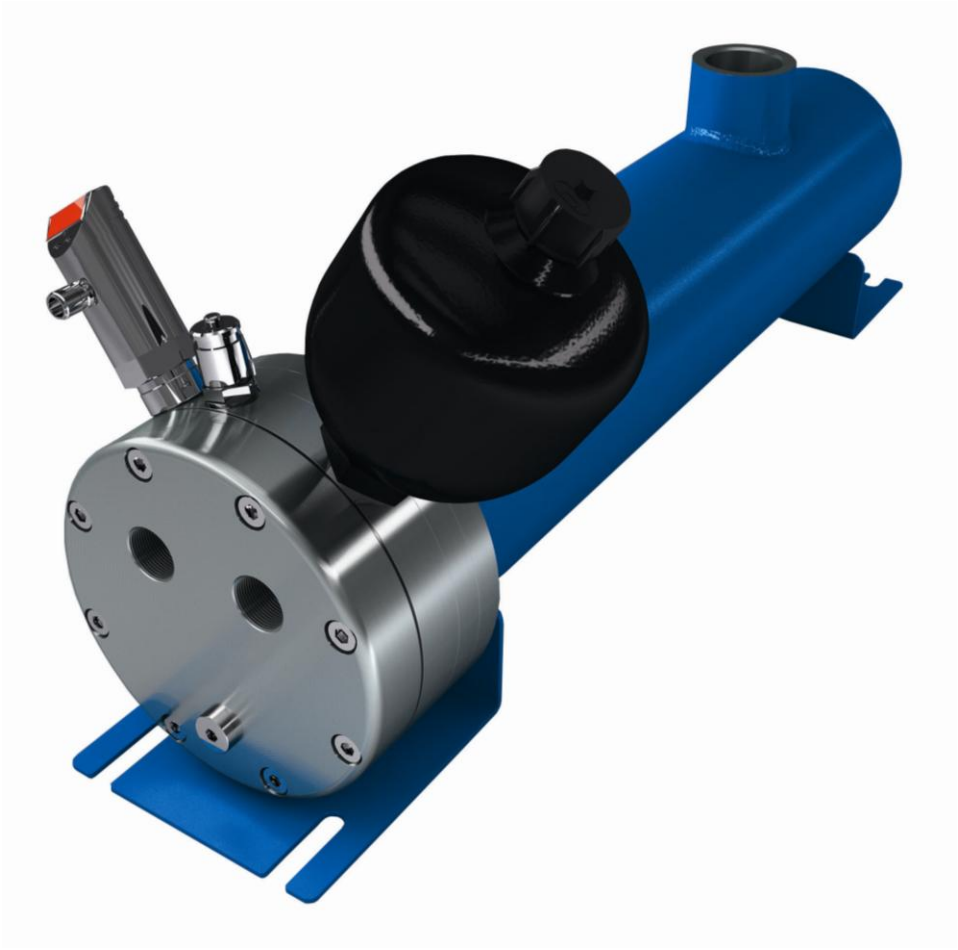
OPERATING INSTRUCTIONS

Shell-and-tube heat exchanger



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1. Implementation

1.1. Notes

These operating instructions describe the functionality and handling of shell-and-tube heat exchangers made by Dipl. Ing. K. Dietzel GmbH.
Any modification in the product will be reserved to further technical development.
For further information, please refer to the data sheets, contact Dipl. Ing. K. Dietzel GmbH or go to www.dietzel-hydraulik.de .

1.2. Use as intended

The heat exchangers made by Dipl. Ing. K. Dietzel GmbH have been designed for use with specific fluids, pressures, temperatures, and other parameters. For the technical data and conditions of use applicable to every heat exchanger, please refer to its nameplate or data sheet. The installation, operation and maintenance of the heat exchangers is not allowed unless to trained specialist personnel, observing both the safety precautions and the operating instructions. The safe operation of the heat exchangers is guaranteed provided that they are used in accordance with their intended purpose and specifications. Any use other than that shall be deemed contrary to the intended use. Liability for any personal injury or damage to property resulting from any such use contrary to the intended purpose shall not be assumed by the manufacturer but rather by the owner of the heat exchangers.

1.3. Warranty and liability

Every product made by Dipl. Ing. K. Dietzel GmbH shall be subject to the general terms and conditions as indicated on www.dietzel-hydraulik.de .

Any warranty and liability claim for personal injury or damage to property shall be excluded whenever such injury or damage may be attributed to one or more of the following causes:

- Use of the heat exchanger contrary to its intended use
- Improper start-up, installation, operation, servicing or maintenance of the heat exchanger
- Any structural alteration carried out on the shell-and-tube heat exchanger without the manufacturer's written permission
- Heat exchanger operation with improper plant connection or defective safety appliances or when safety appliances or safeguards have not been installed properly
- Failure to observe the safety regulations and notes included in these operating instructions
- Improper repair
- Use of any spare part, wearing part, service fluid or cleaning agent other than those approved by the manufacturer

Dipl. Ing. K. Dietzel GmbH shall assume no warranty and no liability other than exclusively for material or manufacturing defects.

2. Safety precautions

DANGER
Warning against possible hazards to life and limb

DANGER
Warning against possible hazards to life and limb due to a hot surface

DANGER
Warning against possible hazards to life and limb by exposure to poison

CAUTION
Warning against possible damage to property or equipment

NOTE
Important general note

NOTE
Important note on environmental protection

2.1. Safety symbols used in the instructions

2.2. Standards and directives

The heat exchanger has been constructed according to the technical rules and standards as currently applicable and it is safe to operate. The fundamental requirements in terms of safety and health have been observed during the development and construction of the heat exchanger as defined in the applicable laws, standards and directives. All safety-related information included in these operating instructions refer to the national laws and EU directives as currently applicable. The relevant regulations governing accident prevention and environmental protection need to be observed in addition to the safety precautions indicated in these operating instructions.

2.3. Plates and labels

2.3.1. Safety symbols used in the instructions

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Figure 1 - "Warning against a hot surface" sign

DANGER
Accident or injury hazard due to missing or damaged safety signs!

- Damaged or missing safety symbols at the shell-and-tube heat exchanger may lead to human errors and consequent personal injury or damage to property.
- Do not remove any danger sign or information sign.
- Replace any danger sign or information sign which may have become damaged, scratched or illegible.
- Use water and soap but no fuel or solvent to clean danger signs or information signs.

2.3.2. Nameplate

The heat exchanger has a nameplate for identification.

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Equipment	WNZ-125-4-0600-5-G112-G034-01-02-02--08		
Item number	WT-00048		
Serial number	000319		
Consignment number	172710		
Date	11/10		
	Tube end	Shell end	
Maximum operating	16	40	bars
Maximum operating		95	° Centigrade

Dipl. Ing. K. Dietzel GmbH, Windmühlenstraße 6, D-04626 Beerwalde,
Tel.: +49 (36602) 140-0, Fax: +49 (36602) 34727,
www.dietzel-hydraulik.de

Figure 2 - Nameplate

Warranty claims will become void when this nameplate is removed. The designation engraved in this nameplate allows the unambiguous identification of the heat exchanger's dimension, material composition and use.

2.3.3. Prefill pressures, switching points

The type plates for the *WNZS* and *WZS* model heat exchangers (safety heat exchangers) also include the following specifications:

- Nitrogen prefill pressure
- Fill pressure for the sealing medium
- Output function (NO/NC) and switching limits for the pressure sensor

2.3.4. Product key

WNZ- 125- 4- 0800- 5- S112- G034- 01- 02- 02- 07- L

	A	B	C	D	E	F	G	H	I	J	K
A	Type of construction										
B	Nominal diameter							80, 125, 175, 250 mm			
C	Number of ways							1, 2, 3, 4, 6 Wege			
D	Standard length and selectable length from tube plate to tube plate										
E	Number of baffle plates										
F	Oil end connection, Water end connection							* Legends circuit points			
G	Shell tube material							01, 02			
H	Cooling water tubes							02, 04			
I	Material tube plate							01, 02, 04, 05, 06			
J	Cover material							01, 02, 05, 06, 07, 08			
K	Fin type							S, M, L, X = Fin size O = without fins			

Figure 3 – Product key

Type of construction

WNZ	Heat exchanger, not pullable
WZ	Heat exchanger, pullable
WTE	Heat exchanger, tank installation
WES	Heat exchanger, screw-in, without fins
WNZS	Heat exchanger, not pullable, safety heat exchanger
WZS	Heat exchanger, pullable, safety heat exchanger

**Legends circuit points*

S	SAE 3000 PSI connection
G	Threaded end
034	¾“
100	1“
114	1 ¼“
112	1 ½“
200	2“
212	2 ½“
300	3“
312	3 ½“

Other connections (DIN – Flange or CEL/CES Connections) optional on demand.

Material code

01	Steel
02	Stainless steel
03	Grey cast iron
04	CuNi 90/10
05	Brass (for WES screw-in cooler)
06	Bronze saltwater-proof
07	Chemically nickel-plated steel
08	Galvanized steel , Cr(6) free
09	Steel + Rilsan coating

2.4. General safety information

- Do not use this heat exchanger other than according to its intended use.
- Do not remove any safety or warning notice attached, and keep them in a legible condition.
- This heat exchanger must not be installed, operated or serviced unless by authorised specialist personnel. Work with care and observe the safety aspects when performing any work.
- Shut down the heat exchanger immediately whenever you become aware of any risk which may cause personal injury or damage to property or the environment.
- In addition to the safety precautions included in these operating instructions, the owner must also observe the general regulations applicable to safety and accident prevention as defined in the country in which this equipment is used.
- Make certain to exclude any mishandling which may lead to a loss of use or impair the environment.
- The personnel must have read and understood the operating instructions prior to erection or start-up. This includes, in particular, knowledge about how to avoid any risk of injury for users or third persons.
- Every safety precaution included in these operating instructions and in every applicable document need to be observed and complied with.
- Observe the regulations applicable to safety at work and environmental protection when performing any work on this heat exchanger, including, e.g., erection, disassembly, transport, cleaning or maintenance.
- Every spare part or wearing part should be ordered from Dipl. Ing. K. Dietzel GmbH as a basic rule. Dipl. Ing. K. Dietzel GmbH does not assume any liability whatsoever for any damage which may result from the use of a spare part made by another manufacturer.

2.4.1. Requirements to be met by the personnel

No work must be performed on the shell-and-tube heat exchanger unless by personnel which has been duly trained, instructed and authorised for such work. The area of responsibility of every person should be clearly defined. Before initiating any activity, the personnel must have been familiarised with the hazards involved in using the shell-and-tube heat exchanger. This heat exchanger may cause a risk of injury if operated by any untrained person. Every person put in charge with operating or servicing the shell-and-tube heat exchanger must have read and understood the complete operating instructions, and be familiar with all safety precautions described therein.

Please observe the following:

- Every safety precaution included in these operating instructions and in every further applicable document must be observed and adhered to without any restriction at all times.
- This shell-and-tube heat exchanger must not be operated unless by trained personnel which has been duly instructed on the technical aspects of safety.

- Such personnel must not present any physical limitation which may temporarily or permanently limit its attention or judgement. This heat exchanger must not be operated and no maintenance, assembly, repair or cleaning work must be carried out by any person who is under age, overtired or under the effect of alcohol, drug or medication.
- The personnel must have sound knowledge of the following operational sequences, regulations, practical procedures and components:
    - Operational sequences in the interplay between heat exchanger and plant
    - Safeguards of the heat exchanger and their proper function
    - Delimitation, protection and identification of danger zones regarding the heat exchanger
    - Behaviour and action to be taken in the event of an emergency
- As are required for the work to be performed, personnel should wear protective clothing and safety gloves, and, if necessary, goggles and respiratory equipment.
- Immediately switch off the plant into which the heat exchanger is integrated whenever a hazard is detected which may cause personal injury.
- Do not eat, drink, smoke or use any naked flame at the location of the heat exchanger.

The operating instructions must always be available to the personnel. We recommend that the owner has a document signed by the personnel to confirm that they have taken note of the content of these operating instructions.

The owner or the personnel trained by the owner is responsible for ensuring accident-free operation.

2.4.2. Safety precautions for the technical condition

Please observe the following:

- Do not make any modification or structural alteration to the heat exchanger.
- Inspect the heat exchanger for damage and ensure it is in a proper condition prior to every start-up. The owner must not operate this heat exchanger unless it is in a faultless and operationally reliable condition. Its technical condition must comply with the statutory requirements at all times.
- The personnel must report any change which occurs on the heat exchanger and may affect safety to the owner without any delay.
- Do not connect the heat exchanger unless exclusively to the feed lines intended and designed for it.

2.4.3. Safety precautions for transport, erection and installation

The corresponding freight carrier is responsible for the transport of the shell-and-tube heat exchanger as a general rule.

The following security requirements should be observed during the transport, erection and installation of the shell-and-tube heat exchanger:

- No erection or installation work must be performed unless by duly trained and instructed specialist personnel.
- Do not carry out any erection or installation work without proper authorisation.
- For transport, secure the components of the heat exchanger as indicated in the specifications applicable to the transport equipment used.
- Do not use any lifting gear or sling equipment unless it has been dimensioned sufficiently for your transport.
- Stay out from under suspended loads.
- Wear a safety helmet.

2.4.4. Safety precautions for operation

Make certain to observe the following safety precautions when operating the shell-and-tube heat exchanger:

- Do not operate the heat exchanger unless all safeguards are in place.
- The owner should provide safeguards including, e.g., safety valves, heat-protective covers, temperature probes, etc., depending on the operational requirements.
- The functionality of the safeguards should be checked on a regular basis. Any defect which may occur must be corrected immediately.
- To avoid unauthorised or accidental contact and unauthorised access, it is absolutely necessary to provide this heat exchanger with a mechanical protection.
- Do not expose this heat exchanger neither to overtemperature nor to overpressure.

- The operating safety of this heat exchanger must be guaranteed at all times.
- The operational conditions must correspond to the intended use of this heat exchanger. Shut down the plant immediately whenever a change is detected at the heat exchanger during operation, including, e.g., an excessively high operating pressure.

2.4.5. Safety precautions for maintenance

The personnel employed for maintenance, inspection or fault correction must have the qualifications required for performing such work.
No maintenance work must be performed unless by duly trained and instructed specialist personnel.

Please observe the following:

- Do not carry out any work on this heat exchanger unless the plant is stopped. Attach a sign at the position where the plant is switched on, warning that work is in progress on the heat exchanger. Lock out the plant to prevent its unauthorised restart.
- Do not use any spare part, wearing part, service fluid or cleaning agent unless approved by Dipl. Ing. K. Dietzel GmbH.

3. Technical data

3.1. Operating pressure and operating temperature

Description	Value
Maximum shell operating pressure	40 bar / 16 bar (WZ, WZS)
Maximum tube operating pressure	16 bar
Minimum/maximum shell operating temperature cover	Minimum 5° C / Maximum 95 °C Avoid steam formation at the water end; higher temperatures are available on request
Minimum/maximum tube operating temperature	min. 5° C / max. 95°C

Tab. 1 – Technical data (For different data, please refer to the nameplate.)

3.2. Materials

Components	Standard heat exchanger	Seawater heat exchanger	Optional
Tubes	CuNi 90/10	CuNi 90/10	Stainless steel (1.4404)
Shell, baffle plate, angle bracket, bypass valve	Steel	Steel	
Cover	Steel	chemically nickel-plated, Bronze	Stainless steel (1.4404), RILSAN coating
Fins	Aluminium	Aluminium	
Tube plate	Stainless steel	Bronze	Steel
Seals	Flat gasket C4400	Flat gasket C4400	Flat gasket C4400

Tab. 2 – Materials used for the heat exchanger

3.3. Water quality requirements

NOTE
All information regarding water quality requirements is given as a recommendation. Unforeseen reactions may occur in exceptional cases when a particular concentration of component substances is present.

Both the water quality and the components contained are important when assessing the cooling water available for its use in the shell-and-tube heat exchanger.

Water quality is determined by:

- Water hardness
- pH-value of the water

3.3.1. Water hardness

Water hardness indicates the content of hardness components (carbonates and bicarbonates). Hardness components will deposit on the tube surfaces especially at a higher temperature, thus reducing the performance of the heat exchanger. A temperature of 63 °C is considered critical. If the water is very hard, these deposits need to be taken into account in the heat exchanger design.

Hardness range	Millimole of calcium carbonate per litre	Degree of hardness in dH (German hardness degree)
soft	<1,5	<8,4 °dH
medium	1,5 – 2,5	8,4 – 14 °dH
hard	>2,5	>14°dH

Tab. 3 - Water quality classification by hardness ranges

A rule of thumb which may be used for converting values into German hardness is as follows:

- 10 mg/l of hardness components correspond to 1°dH

3.3.2. pH-value

The following rule applies to shell-and-tube heat exchangers with copper and copper-nickel tubes:

- pH-value not less than 6 (Corrosion may occur if the value is smaller)

Rule for alkaline water:

- Water hardness not less than 6 °dH (Corrosion may be caused by free carbonic acid if the value is lower)

pH-value	Water quality
4,5	highly acid
4,5 - 6,0	acid
6,0 - 6,8	weakly acid
7,0	neutral
7,2 - 7,7	weakly alkaline
7,7 - 8,2	alkaline
8,2	highly alkaline

Tab. 4 – Classification of water quality by pH-value

3.3.3. Cooling water assessment by its components

The table indicated below provides an overview of the resistance of copper tubes to water components contained in non-drinking water.

Assessment criterion	Value	Assessment
pH-value	<6	0
	6 bis 9	+
	>9	0
Assessment criterion	**Value [mg/l]**	**Assessment**
Chloride	up to 1000	+
	>1000	0
Sulphate	up to 70	+
	70 to 300	0
	>300	-
Nitrate	up to 100	+
	>100	0
Free (aggressive) carbonic acid	up to 20	+
	20 to 50	0
	>50	-
Oxygen	up to 2 *)	+
	>2	0
Ammonium	up to 2	+
	2 to 20	0
	>20	-
Iron (dissolved)	up to 10	+
	>10	0
Available chloride	up to 5	+
	>5	0
Sulphide		-
Ammonia		-

Tab. 5 - Assessing cooling water quality by water components

Explanations on the assessment table column:

+ : Good durability under normal conditions
0 : Corrosion may occur especially when several factors have been assessed as 0
- : Its use is not recommended.
*) : Deoxidized copper proves best when no dissolved oxygen and no sulphide is present in the water.

NOTE
Values higher than those indicated in table 5 apply to copper-nickel tubes as a general rule.

3.3.4. Types and special characteristics of cooling water

Industrial water

- Untreated water (no drinking water) often presents a high amount of impurities. Have the water analysed to assess its quality.
- Copper, bronze and steel provide for a high resistance to industrial water.

Water from brooks or rivers

- Dipl. Ing. K. Dietzel GmbH recommends the use of copper-nickel tubes.
- To protect against corrosion, a suitable coating must be applied to steel elements.
- Untreated water (no drinking water) often presents a high amount of impurities. Have the water analysed to assess its quality.

Sea water

- High content of NaCl, providing for a good electrolyte.
- Mating different materials leads to a risk of electrolytic corrosion. Select materials which are not very far from one another in the electrochemical series, or use a zinc anode.
- Bronze and copper-nickel alloys ensure good durability against sea water.

Brackish water

- Mix of sea and river water.
- Mostly presents a high ammonia and chloride content, so use brass.
- High content of NaCl, providing for a good electrolyte.
- Mating different materials leads to a risk of electrolytic corrosion. Select materials which are not very far from one another in the electrochemical series, or use a zinc anode.

4. Technical Description

4.1. Construction

The pipe bundle heat exchanger is primarily comprised of the following components:

01 - Casing pipe with inlet and outlet nozzles
02 - Pipe bundle with aluminum fins
03 - Tube plates
04 - Dismountable connection cover
05 - Dismountable redirection cover
06 - Drain screw on casing side
07 - Drain screw on pipe side
08 - Screw-on bracket for mounting
09 - Pressure sensor/switch (safety heat exchanger)
10 - Membrane reservoir (safety heat exchanger)
11 - Measurement connection/check valve (safety heat exchanger)

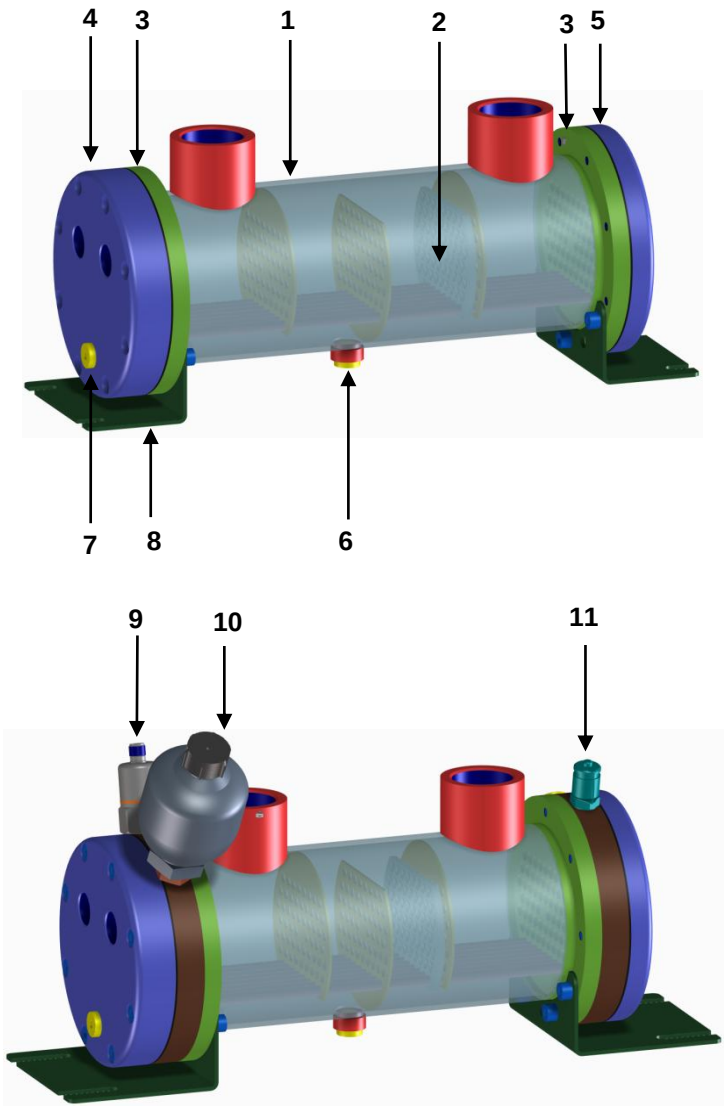


Figure 4 - WNZ (top), WNZS (bottom)

4.2. Connections

The heat exchanger is equipped with inlet and outlet nozzles on the casing as well as inlets and outlets on the connection cover. Due to the increased heat transmission area from the aluminum fins, medium 1 (coolant medium, *see* 3.2.4) is led through the pipes, while medium 2 (medium to be cooled, such as hydraulic oil) flows through the casing space. The heat exchanger is connected as a counter flow or cross-counter flow arrangement as shown in *Figure 5*. In comparison with the parallel flow arrangement, this provides a larger average logarithmic temperature difference, leading to greater heat transmission performance. In the multi-way variant with an even numbers of channels (2-, 4-, and 6-way), the inlet and outlet of both media may be connected arbitrarily. In these cases, the heat exchanger is operated independent of the connection (inlet and outlet direction) by counterflow and parallel flow to equal extents.

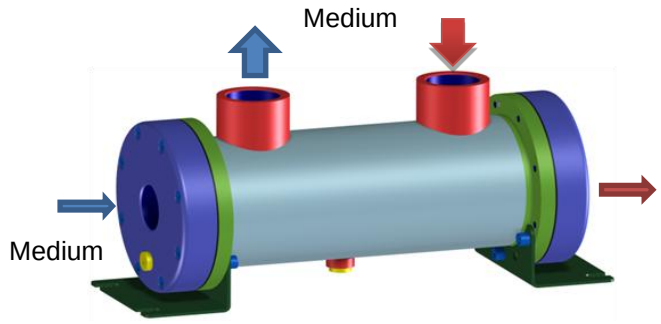


Figure 5 - Connections

There are also drain screws both on the casing and on the connection or diversion cover that are provided for the emptying of the heat exchanger.

4.3. Functional description

The pipe bundle heat exchanger is a pressure container consisting of two pressure chambers (casing side and pipe side) that are separate from one another. The pipe bundle expands the heat transmission area and permits heat transmission between different media by means of appropriate material pairs (with respect to material resistance). The "heat" is taken from medium 2 (the medium to be cooled) through the surface of the aluminum fins and transferred to medium 1 (the coolant medium) and brought out with its fluid flow.

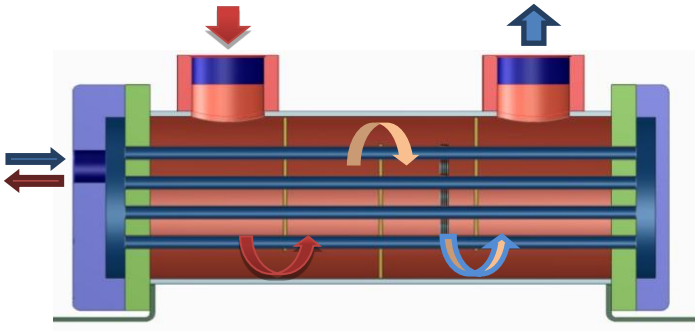


Figure 6 - WNZ cross-section

Pipe bundles with a fin block additionally expand the heat transmission surface on the casing side. This makes this type of pipe bundle heat exchanger particularly suitable for oil/water applications. For water/water applications, due to the fact that the material values (heat conductivity, heat capacity) are the same, pipe bundles without fins are more suitable.

The heat transfer performance is calculated as the product of the average log temperature difference between the two media, the heat transfer area, and the heat transfer coefficients. The heat transfer coefficient is a specific value that depends on the materials used, the material values of the media, and the flow conditions.

A variety of application cases or conditions of use required special layout of the pipe bundle heat exchanger. The layout and calculation tune the variable parameters to one another in such a way that the desired heat transfer performance can be achieved with the smallest possible component size. Adaptation to conditions of use is done primarily using the nominal width, length of the pipe bundle, number of redirection plates, fin spacing, and the number of channels in the pipe. With the options listed here, the pipe bundle heat exchanger can be adapted very well with a cross-flow arrangement to the specific application.

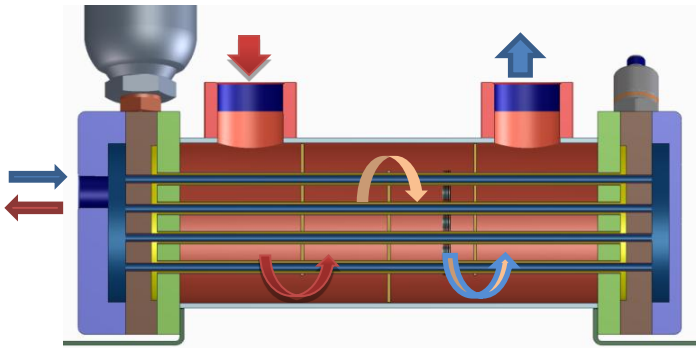


Figure 7 - WNZS cross-section

For WNZS and WZS model heat exchangers, both media are also separated from one another by a sealing medium, shown in yellow in *Figure 7*. This ensures that in case of leaks the two media cannot mix together, ruling out contamination.

In this model series, the pipes of the bundle are double-walled, thus consist of an inner and an outer pipe. The space thus created between them is filled with a harmless, food-suitable glycol/water mixture that serves as a sealing medium.

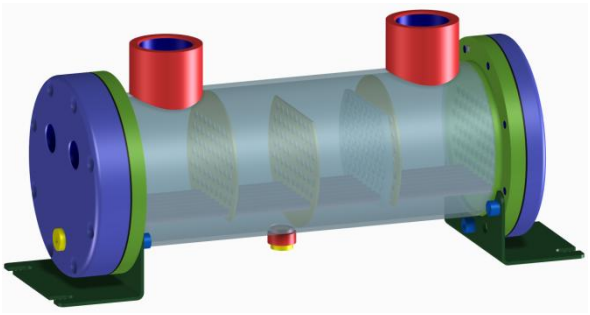
The membrane reservoir is used for volume compensation required due to temperature changes and keeps the pressure in the intermediate space, which is monitored by a pressure sensor, constant.

A leak on one side or the other (pipe space or casing space) would cause a pressure change in the intermediate space which would then be registered by the pressure sensor.

4.4. WNZ and WZ series (universal series)

Draft features for WNZ:

- Straight interior pipes
- Pipe bundle with aluminum fins
- Tube plates are welded to the casing pipe
- 1-, 2-, 4-, or 6-way variants (on pipe side) can be implemented
- Drain screws on pipe- (except for 6-way variants) and casing side



- Holding plates are screwed to the tube plates

Figure 8 – WNZ model

Draft features for WZ:

- Straight interior pipes
- Pullable pipe bundle with aluminum fins
- 2-, 4-, or 6-way variants (on pipe side) can be implemented
- Drain screws on pipe- (except for 2- and 6-way variants) and casing side
- Holding plate screwed on flange side, welded on closure side

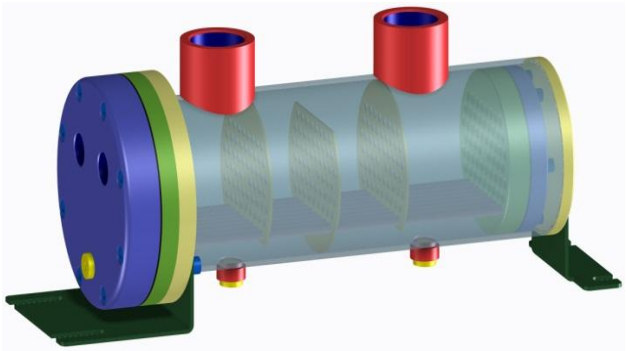


Figure 9 - WZ cross-section

4.5. WNZS and WZS series (safety heat exchanger)

Draft features for WNZS:

- Straight interior pipes
- Pipe bundle with aluminum fins
- Inner tube plates are welded to the casing pipe
- 1-, 2-, 4-, or 6-way variants (on pipe side) can be implemented
- Drain screws on pipe- (except for 6-way variants) and casing side
- Holding plates are screwed to the tube plates

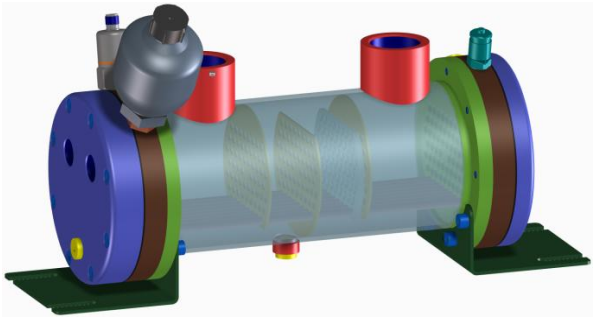


Figure 10 - WNZS model

Draft features for WZS:

- Straight interior pipes
- Pipe bundle with aluminum fins
- 2-, 4-, or 6-way variants (on pipe side) can be implemented
- Drain screws on pipe- (except for 2- and 6-way variants) and casing side
- Holding plate screwed on flange side, welded on closure side

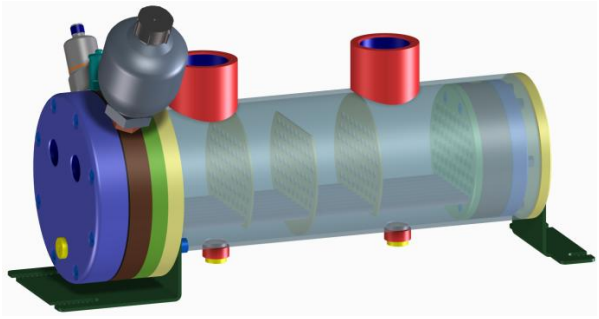


Figure 11 - WZS model

4.5.1. Filling/sealing medium

The intermediate space in the safety heat exchanger is filled with a sealing medium using the measurement connection (EMA3-R 1/4). A 40% propylene glycol/water mixture is used as the sealing medium.

The product specifications and safety instructions for the medium can be found in the Technical Datasheet and the Safety Datasheet (see link addresses).

WARNING
Danger of loss of performance!
It is not at all recommended that you fill the safety heat exchanger with sealing medium yourself.
Incorrect filling media or improper filling can lead to a loss of performance!

WARNING
Danger of escape of media under pressure!
When opening the closing screws, the check valve, or the membrane reservoir, expect the sealing medium to escape under pressure.

Link addresses:

- Technical datasheet
  http://www.terra-calidus.de/media/produkte/frostschutz-glykol/pdf/Technisches%20DB%20Terra%20Gelu%20L.pdf
- Safety datasheet
  http://www.terra-calidus.de/media/produkte/frostschutz-glykol/pdf/SDB%20Terra%20Gelu%20L.pdf

4.5.2. Pressure sensor

The pressure of the sealing medium in the intermediate space is preset. The pressure depends on the system pressures (pipe side / casing side).

The pressure of the sealing medium is preferably between the two system pressures, so that two switch points can be defined above and below the preset pressure. Two switch points include the information regarding which of the two pressure chambers is leaking because the system pressure of the defective side will establish itself in the intermediate space.

The sensor is preconfigured as normally closed (NC) by default. The outputs Out 1 and Out 2 thus permanently emit a diagnostic signal. Thus three conditions must be met to receive a signal. The operating voltage must be applied to the sensor, the signal lines may not be interrupted, and the heat exchanger may not have a leak between the pressure chambers.

The working of the sensor is checked by programming the switch points during filling and setting of the pressure of the intermediate space. Thus the sensor is ready to operate as soon as the operating voltage is applied.

The pressures set, such as the nitrogen prefill pressure (membrane reservoir), the fill pressure, and the programmed switch points, can be found on the label on the casing of the heat exchanger or the technical drawing.

The connection and specifications of the pressure switch can be found in the operating manual and the datasheet of the sensor (see link addresses).

Changes to the programming of the pressure sensor can only be made using the programming and display unit provided (see link addresses).

Link addresses:

- Pressure sensor PP7553 (without display)
  http://www.ifm.com/products/gb/ds/PP7553.htm
- Pressure sensor PN7003 (with display)
  http://www.ifm.com/products/gb/ds/PN7003.htm
- Programming and display unit PP2001
  http://www.ifm.com/products/gb/ds/PP2001.htm

4.6. Tank insert cooler WTE

For heat exchangers in the WTE series, Medium 2 (medium to be cooled) is led into the heat exchanger through an inlet nozzle on the casing and *directly* into the tank through redirection segments.

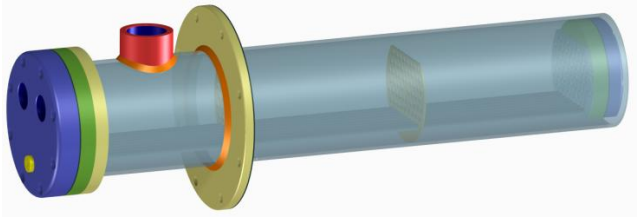


Figure 12 - WTE model

4.7. Screw-in cooler WES

Heat exchangers in the WES series are screwed directly into the tank.

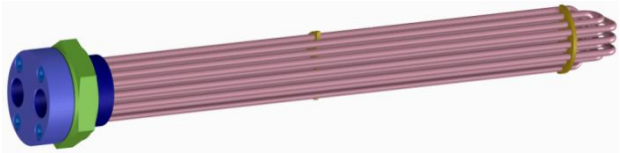


Figure 13 - WES model

5. Transport, storage and preservation

DANGER
Risk of injury by improper transport!
The total weight of a heat exchanger of the WNZ or WTE series may be up to 150 kg. When transporting a shell-and-tube heat exchanger, do not use any lifting gear or sling equipment unless it is dimensioned sufficiently to carry this weight.
No person to be under suspended loads.

CAUTION
Warning against possible leaks from damaged seal faces!
When moving the equipment, make certain not to scratch the seal faces of the connecting flanges.

CAUTION
Warning against possible frost damage!
Drain the cooling water from the heat exchanger to avoid frost damage during storage at subzero temperatures.

CAUTION
Warning against possible damage to tube bundles!
When tube bundles are transported or stored, make certain not to damage or bend the lamellas or tubes.

NOTE
Risk of contamination by preservative agents!
When they are used for treatment, preservative agents must neither penetrate into the ground nor reach the sewer system. They must be disposed of in accordance with the applicable regulations for environmental protection. The same applies to the removal of preservative agents.

Depending on its weight, a heat exchanger will be transported either in cardboard boxes or on pallets. All openings in the heat exchanger are closed by plugs.

NOTE
For information on the selection and use of preservative agents, please contact Dipl. Ing. K. Dietzel GmbH.

NOTE
For storage, please remember to close every port with a plug, and to apply preservative agent in order to protect your heat exchanger against corrosion.

NOTE
Do not exceed a storage period of 2 years.

6. Erection or disassembly

DANGER
Accident and injury hazard!
Before assembling or removing the heat exchanger, shut down the plant and lock it out to prevent its inadvertent restarting.

DANGER
Accident and injury hazard due to improper assembly or disassembly work!
The total weight of a heat exchanger of the WTE series may be up to 150 kg. Use lifting gear or sling equipment which has been dimensioned sufficiently to carry this weight when performing any assembly or disassembly work.

NOTE
Risk of contamination by escaping fluids!
If your heat exchanger is part of a system with a tank or reservoir, please check whether the tank level is higher than the installation level of your heat exchanger before starting its assembly or disassembly. If so, you must drain the tank beforehand.

6.1. Erection conditions

To benefit from the unit's full capacity, please observe the following precautions during assembly and installation:

- To guarantee the free passage of fluids, inspect your heat exchanger for any contamination or foreign material in its inlet and outlet ports.
- When establishing connections, do not use any tubes or fittings unless they are of the same or of a compatible material.
- Make certain to avoid any stress or tension at the connecting branches when connecting the unit to a the pipe system. If necessary, provide supports for pipework or use flexible tubing.
- When connecting your heat exchanger, ensure that the drain openings for fluid 1 (cooling fluid) points downward, and that the drain openings of fluid 2 (fluid to be cooled/fluid cooled) are located at the bottom side.
- If it is used, an automatic water throttle valve should be installed at the inlet to the heat exchanger.
- Route the cooling water outlet pipe so as to ensure that cooling water is flowing through your heat exchanger at all times.
- When installing a heat exchanger of the WTE series, make certain that the flange counterpart at the tank fits precisely and has a planar surface. The tank mounting flange must be firmly connected to the tank.
- When installing a heat exchanger of the WTE series, make certain that your heat exchanger is not exposed to any strong forces or vibrations. To ensure vibration absorption, install a corresponding spring system for your heat exchanger.

6.2. Installing and connecting the heat exchang

Make certain that your heat exchanger is firmly installed at its intended location, and that the pipe connections are properly mounted.

CAUTION
Risk of damage to the system!
Ensure that the inlet and outlet lines are connected each to the correct ports. Please observe the piping layouts.

CAUTION
Risk of cracking!
The use of calking strip on pipe threads leads to a higher risk of cracking in cast elements because it increases the resistance between the parts connected. Do not tighten the threads too firmly.

CAUTION
Risk of destroying components of the shell-and-tube heat exchanger by exposure to seawater or brackish water!
Install a zinc anode to prevent electrolytic corrosion in a heat exchanger which is used in a cooling circuit running with seawater or brackish water.

CAUTION
Warning against reduced performance!
Horizontal installation with the drain outlet pointing downward is preferred for heat exchangers belonging to the BU series. A reduced performance should be expected when these heat exchangers are mounted in an upright or oblique position. If this mounting position is selected, the drain outlet must always be installed at the lower side because no drainage of the heat exchanger will be possible otherwise.
When a heat exchanger of the BTU series is installed in a horizontal position, make certain to turn the heat exchanger so that the drain outlet points downward.

CAUTION
Risk of cracking!
To avoid any risk of cracking, tighten the fastening screws of the connecting flanges evenly in a crosswise order.

To install your heat exchanger, proceed as follows:

1. Drain the tank if necessary.
2. Fasten the heat exchanger:
   Firmly bolt the WTE series to the tank using a tank mounting flange.
3. Proceed as shown on the pipe connection diagram to connect the inlet and outlet lines of fluid 1 (cooling fluid)
   to the corresponding connecting branches at the covers, inserting the corresponding gaskets.
4. Connect the inlet and outlet lines for fluid 2 (fluid to be cooled/fluid cooled) with the corresponding gaskets to the connecting branches at the shell side, tightening the fastening screws at the covers and at the flanges of the feed lines evenly in a crosswise order.

Take the precautions described below to ensure the proper functioning of your heat exchanger in different systems:

- To protect your heat exchanger against contamination and sludge accumulation, Dipl. Ing. K. Dietzel GmbH recommends the installation of the filter unless the cooling water is obtained from your municipal water supply system or from a

closed-circuit system. Have a water analysis performed before starting operation if necessary.

- To avoid contamination, Dipl. Ing. K. Dietzel GmbH also recommends not to conduct fluid 2 (fluid to be cooled/fluid cooled) through your heat exchanger unless it is filtered beforehand.
- To protect the heat exchanger against strong variations in flow or pressure, Dipl. Ing. K. Dietzel GmbH recommends the installation of safety valves and automatic throttle valves in the inlet lines of fluid 1 (cooling fluid) and fluid 2 (fluid to be cooled/cooled fluid).
- To avoid the electrolytic corrosion of any heat exchanger components, a zinc anode should be installed either at the inlet end in the cover or at the inlet line.

6.3. Disassembling the heat exchanger

DANGER
Injury hazard due to pressurised fluids!
To avoid any injury during disassembly, depressurise the system as defined in the accident prevention regulations before starting any work.

DANGER
Injury hazard by a falling shell-and-tube heat exchanger!
Before disassembling, secure the heat exchanger using adequately dimensioned lifting gear and sling equipment to prevent it from falling down.

DANGER
Burn hazard by hot components!
Burns may be caused when touching any heated component. Allow the components to cool down before disassembling the heat exchanger or its feeding lines.

NOTE
Risk of contamination by drained fluids!
Catch and dispose of drained fluids using reservoirs intended for this purpose pursuant to the regulations applicable to environmental protection. No fluid must neither enter the subsoil nor reach the sewer system.

To disassemble your heat exchanger, proceed as follows:

1. Shut down and lock out the plant properly to prevent its unintended restart.
2. Depressurise both your heat exchanger and every system line connected, and shut off the corresponding valves.
3. Completely drain the fluids through the drain plug or drain openings provided; drain the tank if necessary.
4. Disconnect the inlet and outlet lines for fluid 2 (fluid to be cooled /fluid cooled) from the connecting branches at the shell side.
5. Disconnect the cooling water inlet and outlet lines from the connecting branches at the covers.
6. Disassemble the heat exchanger.

7. Operation

When it has been installed properly, the heat exchanger may be put in operation without taking any further preliminary measure. Check the heat exchanger for correct operation after its initial start-up.

To do so, perform the following checks:

- Check the connection points for tightness.
- Check the available filters, valves and fittings for free passage.
- Check the correct function of the heat exchanger.

CAUTION
Risk of plant damage due to loss of performance!
A loss of heat exchanger performance may be caused by furring on the tube side or oil sludge (e.g., due to a defective filter) on the shell side end. Please refer to chapter 8.2 on this point.

CAUTION
To define the maintenance intervals, Dipl. Ing. K. Dietzel GmbH recommends that all parameters be recorded for recently installed heat exchanges in order to allow conclusions with regard to their performance.

Particular features of heat exchangers having a seawater or brackish water cooling circuit:

CAUTION
Risk of damage to components due to aggressive coolants!
Do not use seawater or brackish water or any other aggressive liquid as a coolant in a standard model. Such aggressive coolant requires the use of specific material.

CAUTION
Risk of damage to components due to aggressive coolants!
To prevent electrolytic corrosion, a heat exchanger using a coolant like, e.g., seawater or brackish water must be equipped with a zinc anode at the cooling water inlet end.

Specific materials must be used if seawater or brackish water is used as fluid 1 (cooling fluid) in a heat exchanger. If you intend any use under such conditions, please contact Dipl. Ing. K. Dietzel GmbH.

8. Maintenance, repair and cleaning

NOTE
Risk of contamination by escaping fluids!
If your heat exchanger is part of a system with a tank or reservoir, please check whether the tank level is higher than the installation level of your heat exchanger before starting its assembly or disassembly. If so, you must drain the tank beforehand.

NOTE
No repair must be performed on the tube bundles of the heat exchanger unless in an emergency and unless by authorised personnel. If any such event occurs, please always contact Dipl. Ing. K. Dietzel GmbH.
Analyse any sign of failure and communicate it to the manufacturer.

NOTE
All warranty or liability claims will be void when using any spare part or wearing part other than those approved by the manufacturer.
Please contact the manufacturer to order spare parts or wearing parts:

Dipl. Ing. K. Dietzel GmbH
Windmühlenstraße 6
D-04626 Beerwalde

8.1. Maintenance intervals

CAUTION
Risk of losing performance!
Define the maintenance intervals so as to ensure that there will be no loss of heat exchanger performance which may endanger the operation of your plant.

The service life of your heat exchanger depends on the quality of the fluids and on their components. The performance parameters determined during operation should be used for defining the maintenance intervals which are the sole responsibility of the owner.

Please note the following:

Define the inspection intervals according to the corrosion damage detected during the first visual inspection. The stationary zinc anode needs to be replaced when it has lost approx. 70 % of its zinc quantity.

CAUTIONG
Risk of damage to components due to aggressive coolants!
When it is used to prevent against electrolytic corrosion, check the wear of the zinc anode during the first two weeks after the initial start-up of the unit. Determine the service life and the inspection intervals on the basis of this amount of wear.

8.2. Replacing pullable tube bundles (WZ, WZS, WTE)

CAUTION
Risk of damage to the tube bundle!
To avoid damage to both the tube bundle and the lamellas, prevent canting the tube bundle during assembly or disassembly.

NOTE
For disassembly, 2 threaded holes for inserting forcing screws are located at the flange end of tube bundle.

To replace the tube bundle, proceed as follows:

1. Switch off and lock out the plant to prevent its unintended restart.
2. Shut off every fluid lines, and depressurize the heat exchanger.
3. Drain all fluids, and drain the tank if necessary.
4. Remove all pipework from the cover.
5. Remove the fastening screws from the cover, and pull the tube bundle out of the shell.
6. Clean the shell space of the heat exchanger (see chapter 8.4).
7. Provide a new tube bundle with a new O-ring, and carefully slide the tube bundle into the shell.
8. Mount the cover with a new flat gasket, and tighten the fastening screws evenly in a crosswise order.
9. Reinstall and purge/vent all fluid lines.

8.2.1. Replacing a zinc anode (optional)

To replace the zinc anode, proceed as follows:

1. Switch off and lock out the plant to prevent its unintended restart.
2. Shut off both the cooling water inlet and outlet lines, and the inlet and outlet lines of fluid 2 (fluid to be cooled/fluid cooled) at the heat exchanger.
3. Depressurise the heat exchanger and drain fluid 1 (cooling fluid).
4. Unscrew the zinc anode, assess its wear, and replace it if necessary.
5. Purge the lines before restarting the plant.

8.3. Cleaning

The heat exchanger tube bundles may be cleaned from the inside and, for pullable variants, also from the outside. To determine the cleaning intervals, please refer to the performance parameters determined during operation and to the performance indications. Define the intervals so as to avoid any loss of heat exchanger performance which might endanger a plant operation.

8.3.1. Safety precautions for cleaning

DANGER
Risk of injury by chemical burns or poisoning!
Chemical burns of body parts or eye injuries may occur by a failure to observe the applicable occupational health regulations when cleaning the tube bundle (using, e.g., hydrochloric acid) or the shell space (using, e.g., trichloroethylene).
The applicable safety-at-work regulations must be observed on a mandatory basis when handling any cleaning agent. Wear protective clothing, safety gloves, goggles and respiratory protection when working whether any aggressive cleaning fluid.

CAUTION
Risk of damage to components of the shell-and-tube heat exchanger!
Properly purge the system connected before restarting it.

CAUTION
Risk of contaminating the fluid!
Check that your cleaning agent is compatible with the fluid since experience suggests that it is hardly possible to remove a cleaning agent without leaving any residue.

CAUTION
Risk of destroying heat exchanger components!
To avoid damage which might be caused by wrong treatment, please always contact Dipl. Ing. K. Dietzel GmbH before using any other aggressive cleaning agent.

HINWEIS
Risk of contamination by cleaning agents!
When using any cleaning agent, including, e.g., hydrochloric acid, make certain that they will not be disposed of improperly under no circumstances.
The regulations governing environmental protection in every country must be observed for disposal on a mandatory basis.

8.3.2. Cleaning a tube bundle

DANGER
Accident and injury hazard!
When cleaning a tube bundle, be sure to observe the safety precautions as indicated in chapter 8.3.1 in every case.

CAUTION
Risk of corrosion!
No hydrochloric acid must get on any aluminium lamella when cleaning a tube bundle.

CAUTION
Risk of corrosion by scratches!
Any scratch on the inner surface of a tube bundle may cause increased corrosion. To avoid this risk, please use a brush with soft bristles for inside cleaning.

NOTE
Regarding the use of cleaning agents, please consult Dipl. Ing. K. Dietzel GmbH.

Before it may be cleaned, a tube bundle must be removed from the heat exchanger (only possible for pullable variants).

Please observe the following precautions for cleaning:

- To remove furring on the inner tube side, use a mix comprising 50 % of hydrochloric acid with inhibitors, and 50 % of water.
- To clean the inner surfaces of a tube bundle with tubes having a diameter of <5 mm, use an ultrasonic bath, or rinse the tube bundle with hydrochloric acid.
- Use a brush to clean the inner surfaces of a tube bundle having a tube diameter of >5 mm. Use a brush having soft bristles to avoid scratching that the tube wall surface.
- Clean the outer surfaces of the tube bundle in an ultrasonic bath, or rinse the tube bundle with trichloroethylene.
- Before using any other cleaning agent to remove furring, please consult Dipl. Ing. K. Dietzel GmbH
- After completing your cleaning work, please make certain to remove all cleaning agents from the tubes leaving no residue if possible before putting your heat exchanger back into operation.

For cleaning, perform the following steps:

1. Switch off and lock out the plant to prevent its unintended restart.
2. Shut off the cooling water inlet and outlet ends at the heat exchanger.
3. Depressurise the heat exchanger, and drain the cooling water.
4. Remove the cover.
5. Perform cleaning.
6. Reinstall the cover using new flat gaskets (see 8.3.4).
7. Purge the lines before restarting the plant.

8.3.3. Cleaning the shell space

DANGER
Risk of injury!
When cleaning the shell space, be sure to observe the safety precautions as indicated in chapter 8.3.1 in every case.

Sludge may accumulate and require cleaning in the shell space of the heat exchanger. To allow cleaning, the heat exchanger needs to be dismantled and the tube bundle must be removed.

Please observe the following precautions for cleaning:

- Depending on the degree of contamination, flush the shell space once or several times using a commercially available solvent like, e.g., trichloroethylene.
- After completing your cleaning work, please make certain to remove all cleaning agents from the shell leaving no residue if possible before putting your heat exchanger back into operation.

8.3.4. Reinstallation after cleaning

CAUTION
Risk of fluid escape under pressure!
Avoid damaging seal faces. Do not use any sharp tools to clean a seal face. Tool marks on a seal face may cause a leak. Before installing a new gasket, carefully clean any sealing remains from the seal face. Soiled seal faces may cause injuries, e.g., to eyes, when fluid escapes under pressure after restarting the plant.

1. Remove the old flat gaskets.
2. Clean the seal faces, and remove all sealant residues, while carefully avoiding any damage to the seal faces.
3. Insert new flat gaskets, ensuring their proper fit. Flat gaskets may be ordered by indicating the item number of the heat exchanger. A sealant like Loctite 518 or Loctite 5188 may be applied to increase the sealing effect.
4. Put on the cover in its correct position.
5. Tighten the screws evenly in crosswise order. Recommended torque values: M6 9Nm, M8 25Nm, M10 44Nm
6. To secure the screws, we recommend to apply a locking liquid like, e.g. Loctite 243 or Loctite 2400.
7. It is not necessary to re-tighten the screws.

9. Disposal

NOTE
Make certain that neither lubricants, service fluids, cleaning agents, nor their containers are disposed of as household waste or penetrate the subsoil. Be sure to observe the instructions given in the corresponding data sheets and in the environmental protection regulations applicable in every country.

The heat exchanger must be treated as hazardous waste when it is disposed of.

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